

Project Code and Title

B.02.02.01.04 Vehicle and Restraint Model Development, Maintenance, and Improvement

Project Objective

To develop, compile, and maintain an inventory of software modeling capabilities for the Office of Crashworthiness Research, NHTSA R&D.

Background

Due to the dramatic reduction in cost and equally impressive advances in the state of the art, computer modeling has become an integral part of crashworthiness research. Once a computer model has been established, a multitude of low cost simulations under varied parameters and conditions can be conducted before actual hardware is built and/or tested. In a crash loading environment, such simulations also provide insights into the behavior of the structure under various loading conditions which are not easily achieved or, in certain cases, simply cannot be achieved via experimental testing due to physical restriction or instrumentation limitations. This applies to all areas of vehicle and restraint crashworthiness research, whether developing component compliance tests or to better understand the interaction of a particular restraint system with other sections of the occupant compartment.

Problem Definition

Since computer modeling has become an integral part of crashworthiness research, it is paramount to develop, acquire and maintain the needed capabilities and state of the art tools to perform the needed modeling and corresponding analyses. The capabilities involve advance computer hardware, including state of the art workstations and personal computers, and massively parallel processing capabilities. Also, software capabilities are critical and their availability is tied to specific computer hardware platforms and models. Software capabilities include lumped mass, rigid body, and finite element (FE) modeling and structural analysis, pre and post processing, visualization and animation, etc. Development of lumped mass and rigid body structural model from crash tests data, component tests and geometry studies is needed for vehicles, dummies, and restraint systems. This is necessary for fleet characterization studies, for performing countermeasure design and effectiveness studies, and also for performing parametric studies in support of crash testing and test procedure development. Development of FE models using reverse engineering of mechanical systems is also needed for components, vehicles, dummies, and restraint systems. This is necessary to perform detailed structural analysis for determining and studying occupant contacts, kinematics, and for understanding the interaction of occupant with the vehicle and the restraints or countermeasure systems.

Research Approach

Tasks under this project will be carried out to evaluate and develop modeling capabilities, tools, and features, and to identify available data sources. Libraries of compatible occupant/vehicle model datasets will also be developed. Currently, tasks 1 through 10 are identified.

Potential Impact/Application

All safety standards supported by modeling of crash/sled/component test data.

RESOURCE REQUIREMENTS	FY 96	FY 97	FY 98	FY 99	FY
Contract Money (\$K)	175	850	850	850	

Project Manager(s)

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Completion Date

This analytical support project is ongoing.

Keywords: model, vehicle, restraint, countermeasure, rigid body modeling, lumped mass modeling, finite element modeling, PNGV, massively parallel processing

Project Tasks

Task Title and Description

Task 01	Advanced Modeling Tools - Software
Task 02	Advanced Model Tools - Hardware
Task 03	SISAME (Structural Impact Model Extraction & Simulation) Development & Support
Task 04	Frontal FE Model Development of Mid-size Passenger Car (PC)
Task 05	Full FE Model Development of a Small PC
Task 06	Air Bag Modeling: Early deployment Phase
Task 07	FE Modeling Support - Multiple Size Occupant/Material Model Development
Task 08	FE Modeling Support - User agreement for Use of Super Computing Resources
Task 09	FE Modeling Support - FE Model Development of EEVC Barrier
Task 10	Massively Parallel Processing Computing Capability to Support NHTSA Efforts in the Partnership for a New Generation of Vehicles (PNGV)

Task	Start Date	Projected Completion Date	Status/Responsibility
01		Ongoing	Currently licensing MADYMO, LS-DYNA3D plus pre & post processing tools
02		Ongoing	Current platforms: IBM RS/6000, DEC alpha; Memory/Hard disk/CPU/Graphics cards upgrades as necessary; SGI platform planned
03		Ongoing	1-D extraction/simulation development mainly complete; Initial 3-D design & capabilities planned for FY 97
04	2/93	4/94	FE model of Taurus verified in an NCAP and frontal offset impact
05	8/96	8/97	FE model of Neon verified in an NCAP and rear impact
06		TBD	Pending availability of rugged instrumentation
07	10/95	7/96	FEBOD - interface with DYNA3D for modeling different sized occupants
08	10/95	TBD	Use agreement for use super computing resources at ORNL
09	10/95	12/96	FE model of EEVC barrier
10	FY 97		Awaiting Congressional funding (approved for FY 97)